

Remark

Applicants respectfully request reconsideration of this application as amended. Claims 1, 3, 4, 5, 8 and 10 have been amended. Claims 2, 6, 9 and 12-20 have been canceled. Claims 1-27 have been Withdrawn. Therefore, claims 1, 3-5, 7, 8, 10 and 11 are now presented for examination.

35 U.S.C. §103 Rejection

Maes, Nguyen and Ohmi

The Examiner has rejected claims 1-8 and 10-11 under 35 U.S.C. §103(a) as being unpatentable over Maes, U.S. Patent No. 6,818,517 (“Maes”) in view of Nguyen, U.S. Patent Publication No. 2004015845 (“Nguyen”) and in further view of Ohmi, U.S. Patent No. 6,669,825 (“Ohmi”).

The Examiner has indicated that the prior amendments and remarks are moot in view of the new grounds of rejection. This rejection is new in that Ohmi has been added to show chamber generated plasma. The rest of the rejection remains the same.

Previous Remarks

Applicants previous remarks focused on two main points. The first point was that in the claimed invention the plasma starts, then plasma power is applied, then the deposition gas is added, then the deposition gas flow is stopped, then the plasma is stopped. The Examiner has made no response to this first point.

Applicants previous remarks also made a second point which was that in the claimed invention, plasma power is applied to the chamber in an RF form. The Examiner has replied to this second point indirectly by citing Ohmi.

The Present Invention

As explained at paragraph 29 (page 10, lines 14 et seq.), “the low silane flow, optimized silane/ammonia ratio, and plasma timing may provide an elimination of intra-film silicon-rich interfaces that are common in sequential deposition. It may also result in a dramatic reduction in Si-H concentration in the bulk film, a 10x film resistivity improvement, and a 2x improvement in tunneling strength.” Claim 1 recites aspects of the plasma timing. Claim 2 recites aspects of the plasma timing in sequential deposition. It is now incorporated into Claim 1.

The References

As to the references, none of them suggest the plasma timing as claimed in sequential deposition. Maes uses the introduction of nitrogen radicals for silane deposition but not in a sequential process. Nguyen shows sequential ALD, but there is no plasma and there is no silane or other deposition gas. Ohmi uses a plasma but not for deposition. Ohmi uses the plasma to induce nitridation of an existing silicon layer (11:37). The rejection is therefore a piecemeal collection of references in the semiconductor field which all relate to different processes.

Claim 1 specifically refers to a deposition gas. This is only in Maes which uses a different form of plasma. The claimed deposition uses plasma power applied in an RF form. This is only in Ohmi which does not have sequential deposition, nor the plasma timing. The claimed deposition in sequential which is only in Nguyen which does not use plasma and deposits different types of layers.

The Examiner provides a motivation to combine these disparate references as “in order to take advantage of lower temperature reactions for modern semiconductor

processing to deposit film of high coverage on a not-flat substrate such as vias or trenches in semiconductors, minimize process time and enhance film quality.” Applicants do not understand where this motivation comes from, nor how it relates to the references or to the claimed invention. Except for the general statement about higher quality, this motivation has little to do with the present invention. Pulsed plasma is commonly used to manage the temperature in the chamber, but this is not an element of the pending claims.

Applicants accordingly submit that there is no motivation to combine these disparate references as the Examiner has suggested. There is nothing to suggest that such a combination would be made in the way recited in the pending claims. There is nothing to suggest that such a combination would obtain the advantages of the present invention.

Conclusion

Accordingly, Applicants respectfully submit that the rejections have been overcome by the amendment and remark, and that the claims as amended are now in condition for allowance. Accordingly, Applicants respectfully request the rejections be withdrawn and the claims as amended be allowed.

Invitation for a Telephone Interview

The Examiner is requested to call the undersigned at (303) 740-1980 if there remains any issue with allowance of the case.

Request for an Extension of Time

Applicants respectfully petition for an extension of time to respond to the outstanding Office Action pursuant to 37 C.F.R. § 1.136(a) should one be necessary. Please charge our Deposit Account No. 02-2666 to cover the necessary fee under 37 C.F.R. § 1.17(a) for such an extension.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

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